Listening to renewable energy technologies

Listening To Renewable Technologies

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Abstract

This chapter is focused on the development of a methodology called Listening as Practice. The paper discusses the development of this method and insights drawn from the field. The research draws on three years of listening within several unique soundscapes with very different natural landscapes: the southern region of Iceland and the northeast region of Spain. Each space contains significant sites of renewable technologies from hydroelectric power to wind farms. The sounds produced by these technologies have altered the author's impression of renewable energies in natural landscapes. A key question to ask with the emergence of any new technology is what is its potential impact on the sociological and ecological environment. This is even more important when there is an almost unilateral consensus that the use of renewable technologies to replace more harmful energy sources takes precedence over any possible socio-cultural or environmental impacts.

Keywords

Acoustic ecology, listening, field recording, soundscapes, sound art.

Introduction

The paper explores field trips taken between 2015 and 2017 recording vastly different soundscapes; the first, the southern region of Iceland, the second, the Northern Terra Alta region of Spain. The trip to Iceland took place in June 2015, and was followed by two trips to Spain in July 2015 and August 2016. It was during the field trip to Iceland that I began to explore the sonic impact of renewable technologies within various acoustic territories. When exploring the soundscapes of renewable energy technologies I was surprised to discover the perceptible sound levels were quite high. In addition, there was a noticeable socio-economic and cultural impact as a result of the emergence of renewable energies in certain regions. This particular impact was documented through a listening practice, which found a marked reduction of population

sounds and/or a reduction in traditional economic practices, which could be defined as archetypal or historic sounds.

It is assumed that the design of these technologies are influenced and shaped by ethical considerations for the landscape. Further, that the process of developing these technologies are grounded in holistic concerns, a gestalt view where the environment and surrounding ecosystems, including human ecosystems, are considered within impact studies. The following paper explores how the development of a listening methodology allowed for a deeper understanding of the potential impact of a technological system within these two distinctive soundscapes.

Energy and the Landscape

Sustainable energy is increasingly defined as the only way forward for a planet suffering from environmental harm due to polluting energy sources such as coal, gas and oil. Pollution is often defined in terms of physical materials, which infect all ecosystems with problematic gases or chemicals, through processes of manufacturing and/or extraction[1]. Considering the environmental impact of these energy sources it can seem problematic to question potential side effects caused by renewable technologies or renewable infrastructures. However, it is our history of not examining the long term impact of new technological systems which has lead to our current environmental problems. Through auditory observation researchers can become aware of the very different and subtle ways in which structures that harness and produce energy might begin to shape or alter social and environmental ecologies.

Rachel Carson (2000) posited that man's poor management of land would lead to what she called the Silent Spring, a process whereby the soundscape of nature starts to disappear as habitats become uninhabitable. The loss of the natural soundscape would be the first fundamental shock to the system and would herald the decline of the natural environment (Whitehouse, 2015). However, because listening is not foregrounded in environmental science we would fail to take notice of these silences until the physical and visible side effects appeared.

The emergence of the field of acoustic ecology has lead to a significant number of findings framed within an audible methodology, that is recording and analysing the sounds produced in particular environments and the impact these sounds have on a natural ecosystem. Listening to

[1] https://www.conserve-energy-future.com/pollutiontypes.php

nature is now encouraged and even advanced by acoustic ecologists such as Leah Barclay (2017) and organisations such as the World Forum for Acoustic Ecology and the Acoustic Ecology Institute. A growing movement of environmentally aware sound artists and field recordists have documented the impact of noise pollution and polluting technologies within various biospheres. Artist researcher Anja Kanngieser posits that sound allows us to hear the political and socio-economic "between humans, environments and systems of governance" [2]. However, by incorporating transdisciplinary processes for soundscape examination, we have the ability to transcribe in detail what is happening within complex biological and social systems.

Listening in Practice: a Methodology

During the three-year period of research from 2014 - 17 I developed two modes of listening, both involved uniquely different approaches to documenting and understanding a soundscape. These have been shaped by previously developed methods for soundscape research concerning the impact of shifting urban soundscapes on communities (L O Keeffe, 2015; Linda O Keeffe, 2015). Epstein (2009) states that the key component of the field of acoustic ecology is its hybridisation of interdisciplinary problem solving. In listening to our environment we must not only explore such concerns as noise and its impact on certain environments but also include an examination of the social experience of sound, the cognitive and psychological impact of different types of listening experiences, and the aesthetics of environmental sounds. First, the process of documenting the landscape becomes a sort of mapping method; whereby each heard space would be noted by time, weather conditions, a linking of sound, effect to production, the position of the listener relative to the sound, and a catalogue of what is seen and sensed other than sound. The use of the word mapping implies a flattening of the perceived space, a traditional cartographic approach, which de Certeau (1988) argues ignores the subjective experience of place. Instead, I created an assemblage of data from note taking to audio, video and photographic documentation, non-prescriptive open-ended interviews and participant observation. This approach involves a form of embodied listening where one tries to interpret what role sound plays in the environment and within communities including how some sounds impact on both social and natural spaces. When thinking of a space in three dimensional terms it is important to examine the entire ecosystem from the sounds produced by economic practices, contemporary, traditional or lost; community and cultural sounds, natural environmental sounds, both geophonic and biophonic, and the stories told by locals. It is also important to reflect on the listeners experience of a space, what connections and knowledge they may have about the space, to assess one's subjectivities. This mode of listening is shaped by an awareness of the

[2] http://anjakanngieser.com/about/

social shaping of land and community structures as well as the method of attentive and observational listening.

Second, using the Oliveros (2005) approach to listening the Deep Listening method, it is possible to develop a listening practice whereby passive and active listening, or directional and focused listening allows an attentive listener tune sound in or out, or manage and comprehend past sounds, making links between what is heard and what is remembered. Passive listening in this instance becomes a process of being immersed in a current sound environment while reflecting on previous sensory moments whether this was a story collected or previous listening moments. Then note taking and or dictating the experience becomes a key tool to support the documentation of sonic moments. In this way the act of listening becomes as important as the process of recording sound for documentary purposes.

The overriding issue when recording environments for later listening and analysis is how memory and subjectivity might interfere with our interpretation of the experience. Interpretivists contend that it is the experiential moment that is important (Rabinow & Sullivan, 1988), and a recording can only ever be an indication of what sounds were in a space at a given time. It does not document how sound is perceived by the listener, but what it can do is document what impact a sound might have on other sounds. The recording technology became an extension of my listening experience (Ihde, 2007), but it was not the only process by which I was documenting the space. In recording this space it was necessary to step back from the technology and instead pay attention to the entire sensory moment. The experience of listening and documenting became a holistic one, whereby the sounds, sights and smells were examined in context to each other. This means interpreting in what way each sensory experience impacts on others or how one sound might evolve in relation to other sounds.

The following sections offer a detailed description of sites of listening exploring the links between the technological infrastructures of renewable energies, their potential impact on natural landscapes, and their influence on local social, economic and cultural practices.

Listening to the Icelandic soundscape

In 2015 I travelled to Iceland as part of a field-recording group to document this varied and beautiful landscape and the sounds it produces. When documenting the soundscape it was difficult at first to remove myself from the concern of recording 'noise'[3] free environments. However, on day three I returned to the meditative practice of listening without judgement, an

[3] In this instance I use the term noise to indicate man made sounds, such as cars, planes and people.

approach developed by Oliveros (2005). This argues for a deeper attention to the sonic environment. When one listens deeply, they discover not only the nuances of sound in space, but also the ability to reflect on the meaning of these sounds in their everyday lives. I adopted a holistic approach to listening, analysing the meaning of all sounds in the environment, man made or natural, reflecting on the relationship Icelandic people have with this landscape, and how the land is used.

During the field trips an immense variety of sounds were recorded from birds within forests and marshes, to the gurgling, hissing and bubbling of sulphur pools, the explosions of steam and water from geysers, and the sounds of melting icebergs recorded underwater. In addition, we were recording during the summer period, where the sun never really sets; this meant we would record during the night and sometimes into the morning the very different wildlife that occupy various sonic terrains within the soundscape. Everyday we would drive to a new space, set up our equipment and hope to document something different. Then in the evening we analysed the days recordings and shared stories about previous sonic experiences. One of the most interesting and strange animal sounds I heard on this trip was that of the Common Snipe; when it flaps its wings the sound is almost mechanical.

Renewable technologies: the sound of nature harnessed

In recent years Iceland's major energy source has moved towards hydroelectric power. There are a number of large powerful rivers and these have been harnessed to feed the energy requirements of this relatively small and isolated country. This has meant that they have become less reliant on the importing of coal, oil or gas. In comparison to oil or gas production the ecological impact is minor. On one of the field recording days the group spent time inside one of these stations, it was this listening experience which began a deeper analysis of the ways in which listening might offer insights into potential ecological and social impacts.

Inside the station were 5 levels with 4 below ground. At each level the sound became louder and deeper in resonance, with the sound of turbines resonating and vibrating through the space and through our bodies. On the lowest floor, where the river was directed through the plant the sound was at its most intense and pressed against the ear and the body. I used mainly binaural and contact microphones to document the resonances of this space. After only an hour of recording I began to feel nauseous and was forced to leave the building. I was not alone in experiencing this embodied effect. Several others left, stating they didn't feel well and needed to get away from the continuous rumbling and whining of the many machines and turbines.

Outside the station the sounds were faint, but beneath our feet the wave propagation produced by the turbines was travelling through the land and the river.

Inside the hydroelectric power plant

Figure 4. Recording the river outside the power plant

On exiting the plant it became impossible to ignore the potential for these resonating sounds to impact on subterranean or underwater ecosystems, the sounds radiated throughout this structure of concrete and metal. Low frequency sounds have the potential to travel through objects and surfaces (Howard & Angus, 2009) and are known to cause physical reactions (Stocker, 2002). When outside the station I decided to place a hydrophone in the river, the sound recorded was a constant repetitive low rumbling sound. A more effective form of documenting these sounds is required, over longer periods of time, to create an accurate analysis of these sounds and their potential impact on the wildlife of the river.

Researchers have suggested that oceanic and river environments are acoustically under threat. Helmreich (2011) and Stocker (2002) argue that oil drilling, factory fishing, and pleasure boating produce anthropogenic noise, sounds caused by humans (Pijanowski et al., 2011), which they counter, must affect marine life. Stocker has highlighted the biological importance of sounds produced by underwater creatures, suggesting that sounds produced by various underwater life forms are necessary to their survival. Any sound, which masks or disrupts their ability to communicate, could damage an ecosystem. To date there has been little investment in ecological studies or programs to determine scientifically what the side effects may be of hydroelectric turbines. There is some research to indicate that hydrokinetic energy turbine sounds can have an impact on certain species of fish, with the strongest recorded impacts happening when sounds reached an average SPL level of "163 dB re 1 µPa for 24 h" (Schramm, Bevelhimer, & Scherelis, 2017, p. 1). Fish are extremely sensitive to low frequency vibrations, usually associating those sounds to predators. This means they will swim away from that sound. This has the potential to create an "avoidance response" (BIAS, 2013) which could "affect normal behaviour related to movements, feeding, and reproduction" (Schramm et al., 2017, p. 1) resulting in significant 'ecological consequences'. In part, one could argue that because the eco system and soundscape of oceans and rivers are invisible and inaudible to humans, it has been easy to ignore the impact of certain technologies on the underwater soundscape.

While field recording on the trip to Iceland one key sound acted as an intrusion on our ability to document the natural soundscape that was the sound of tourism a growing soundscape of tour planes and boats, coach loads of people visiting remote sites from glacial lakes to volcanic mountains, often these sounds masked our ability to record unique environmental sounds. The obvious anthropogenic sounds: cars, boats, planes and human voices, were clearly identifiable, and have often been defined as problematic to our environment. Yet it was the soundscape of the hydroelectric power stations that affected me the most with the constant low frequency pulses moving through the rivers and subterranean spaces of the Icelandic landscape. Their potential to harm an ecosystem is perhaps just as lethal as cars, boats and planes, however, as an environmentally friendly energy, causing little chemical pollution; it is problematic to critique them.

The emergence of the Listening as Practice method in Iceland included the development of new sound mapping techniques and drawings, alongside audio video art works shaped by the sounds recorded on the trip, see images below. In July 2015, following the trip to Iceland myself and the composer Tony Doyle travelled to Spain to record the vast wind farms of the Terra Alta

region of Northern Spain. We returned in 2016 with several other artists as part of an acoustic ecology residency that we developed for this region.

The Terra Alta soundscape July 2015

The Terra Alta area of northern Spain is a vast mountainous region with summer temperatures reaching as high as 38°C leading to parched landscapes, dry riverbeds, brittle fallen leaves and branches piling up on the ground. The winters reach well below 0°C with snow and freezing rains from October to March. Its agriculture is concentrated towards vineyards, almonds, cherry's and olives with a number of co-operatives producing jams, honey, olive oil and fruit liqueurs. I began listening to this region in 2008 and from 2014 there was a noticeable change in the natural and socio-cultural soundscape, this can in some ways be linked to the introduction of a new technological infrastructure, wind farms.

Wind turbines Terra Alta Mountains 2016

Listening to the mechanical and the natural

Following the Icelandic trip in 2015 myself and the composer Tony Doyle began a month of audio video field recording in the Terra Alta region. It was during this first Spanish field trip that the Listening in Practice method began to be refined. The method involved focusing on environmental sounds, socio-cultural sounds, including the documentation of stories, conversations and festivals. In addition, we were examining the potential of representing these findings in creative contexts.

Recording the Turbines

Listening to Crickets

Most of the recording took place in the Serra de la Fatarella mountain range; a site of historical importance as it has many stone constructed dug outs created during the Spanish civil war. There are a number of walks that snake around the mountain allowing easy access to remote locations, during the day the sounds of various vehicles, the boom of planes overhead and occasionally the sound of a tractor could be heard from all around. Embedded within this region are a significant number of wind turbines (see images above), and the turning of the blades and engine within the base is heard clearly at a distance of approx. 100 meters. The sounds of this space including the wind turbines were recorded with a variety of microphones from a boom microphone to a contact microphone and using the stereo inbuilt microphone of a zoom recorder. The process of recording the turbines involved moving outwards by degrees, focusing on how the sound changed as it was diffused by trees, bushes and wind, as well as the change in the physical landscape. What was very noticeable during these recordings was the soundscape of crickets around the turbines. When soundwalking through the mountains, as one approaches crickets, there is a sudden drop in sound as they respond to what they sense is a predator. It takes time sitting and not moving for the cricket soundscape to re-emerge. When walking around and near the turbines, even when setting up equipment, the crickets never stopped chirruping; it was as if they couldn't hear our sounds above the sound of the turbines.

In addition to recording the natural environment a number of informal interviews took place which included recording the sounds of daily life in the village, documenting both the circadian (linked to farming practices) and the technological rhythms of the space dictated by other types of industry. A number of residents now commute to work in larger towns and cities. A decrease in local employment, including a reduction in farming work, has meant more of the community leave to work in cities, a statistic evidenced in the wider rural community in Spain

and Europe[4]. The appearance of wind turbines in the region has meant, for some, a boost in finances; farmers receive a subsidy for every turbine on their land. This means there is less of a need to farm as much with this new income. This has the resulting impact of changing the soundscape of these rural spaces, which were intrinsically linked to the biological rhythms of nature. The geographies of space and the social world are now merged with the social geographies of the technological world (Castells et al. 2009); this is increasingly true in remote areas with the emergence of renewable technological infrastructures. The countryside is now being shaped by the emergence of machinic rhythms within the circadian soundscape of natural and rural spaces. This can be seen as a mirroring of the changing soundscapes of cities since pre-industrial time, where certain aspects of the circadian rhythm of rural spaces still existed in city spaces (Lefebvre 1992), but dissolved with the influx of mechanical technology.

As a result of this initial field trip Doyle and myself decided to develop an acoustic ecology residency in 2016. We would select a small number of sound recordists and artists to locate themselves in this region in order to explore this changing soundscape. Additionally, in 2017 the art work Hybrid Soundscapes and the paper Listening To Ecological Interference: Renewable Technologies And Their Soundscapes was presented at the Balance UnBalance conference (L. O Keeffe, 2017b, 2017a).

La Fatarella 2016 - The Acoustic Ecology Residency

In August of 2016 Robin Parmar and Matt Green were selected to participate in a 10-day acoustic ecology residency in La Fatarella. The residency included a number of excursions to different wind farms, the Ebro D'elta nature reserve and visits to a number of towns and cities. Myself Parmar and Green also participated in a concert organised by SIRGA, a sound art organisation based in Catalonia. Presenting our field recording experiences in the form of sonic art performances and discussions.

[4] http://ec.europa.eu/eurostat/statistics explained/index.php/Agricultural_census_in_Spain#Main_statistical_findings

Matt Performing in Flix

Linda Performing in Flix

In continuing with the Listening in Practice method this field trip began with broader approach to examining the soundscape. It included more in-depth interviews with residents, documenting cultural events and activities in the region, and increased field recordings of the natural soundscapes with a focus on documenting both audio and visual information. Additionally, I began to document my subjective experience of this area through a series of autoethnographic sound walks; auto-ethnographies take the form of connecting the personal to the "cultural, social, and political" (Davis and Ellis 2013). Taking a holistic approach to listening means paying attention to the entire sonic environment, as the sounds of a place, both natural and manmade, play a large part in defining a space culturally, economically, socially, and geographically.

Birthday Festival La Fatarella

Diablo Festival Tarragonna

Listening became an integral part of noting differences in the environment; the drop in numbers attending festivals, the decreased farming sounds, the low numbers of children playing on the streets, and the steady sound of the turbines whirring in the mountains. Additionally, a

number of anecdotal stories emerged concerning the drop in bird sounds particularly the sounds of swallows, and a decreased presence of wild boars and other small mammals in the woods. Locals were noticing small changes in the local ecology with no immediate understanding as to why this was happening. There is little research on the impact of wind farms on wildlife, however, a recent study by the UK Royal Society for the Protection of Birds found that wind farms, while essential, if poorly sited cause harm to bird populations from "disturbance, habitat loss (both direct and/or indirect) and collision" (RSPB, 2017c). They have argued that it is necessary to examine what impact, if any, new technologies might have on the natural environment. Although the wind farms have come to provide a much needed source of income to these rural communities there is evidence that the impact of this radically different economy is changing the face of this communities, and perhaps affecting the natural ecology. Most of the farmland in La Fatarella is passed from parent to child, providing a continuation of land practices, employment, and community, and cultural activities linked to this economy. La Fatarella has witnessed a population decline since the 1990s from 1400 to 1004 in 2016 [5]. This drop is seen as a real concern for the future of La Fatarella, without a young population schools would close down, there would be little need to develop infrastructural projects in the village, and property prices would drop due to a lack of buyers. Most of the property in La Fatarella, like other small villages in the region, were bought and sold by families and locals. With the emergence of wind energy there is no need for intensive farming, which might lead to disengagement with the land. What occurs then is that the young population are leaving the region for larger towns and cities for employment and education opportunities (Delle Femmine 2017), leading to an eventual silencing of these ancient rural communities.

Following the second field trip to Spain I undertook a research trip to Beijing and to Barrow in Furness in the UK, both trips allowed for a further development of the Listening in Practice method and in October 2017 this collection of material was presented as a body of artwork at the Sounds Like Her exhibition, curated by Christine Eyene, at the Nottingham Art Exchange Gallery. The exhibition was an attempt to represent the immersive experience of data collected and analysed from each sonic environment since 2015.

[5] Population statistics provided by https://www.citypopulation.de/php/spain-cataluna.php?cityid=43056

Conclusion

The development of the Listening as Practice approach allows researchers to make audible and visible the impact of new technological infrastructures on different biological and social systems. Sound as a phenomenological experience is: non-linear, exists in multiple spaces simultaneously, *and* happens over time. Its influence is not localised to its source, and in the process of examining the effect of a soundscape one must look at all the spaces for which it might have an impact. By including an ecological perspective with a social analysis of the interaction and impact these systems have on the living conditions of humans and other species, we highlight the deep and necessary links needed to create a balanced ecosystem. Additionally, the Listening as Practice method attempts to engage a broader audience with community engaged art processes like sound walking and sound mapping projects[6], as well as finding new ways to present findings through performance and exhibition. This means that the research findings are not limited to academic circles and have the potential to shape a communities engagement with a new technological infrastructure.

The paper does not suggest discarding renewable technologies but applying a new level of interrogation into any potential impacts it might have on an ecosystem, regardless of its overall benefits. The systemic use of technology in everyday life has definitively altered our relationship to space and ideas, and technological determinists would argue that this is of course the natural process of a ubiquitous technological world. However this has the potential to promote a passive attitude to any technological change. The development of technological systems or objects is neither linear nor inevitable. Technologies are embedded with the social and political interests of a culture, and the design of technologies is a constant and open process, dependent on the needs and circumstances of society. In listening to the soundscape of a technological system one can become alert to the potential impact on a biological and social system.

Using Listening in Practice allowed for the collection of materials, which highlighted systemic changes in the social and natural environment. This meant standing back from the larger ecological and environmental goals of renewable technologies and focusing on macro technological soundscapes and the hegemonies that control this new auditory environment. Combining techniques such as sound mapping, drawing, recording and listening allows for a more in depth collection of data, which reveals interconnections between diverse spaces, objects, technologies and communities. It is at the point of hearing the whole that one

[6] See work undertaken in Singapore in 2016 http://lindaokeeffe.com/blog/#/blog/composing-the-singapore-soundscape-at-nus/

understands how a shift in the soundscape can have a ripple effect beyond the source of that sound.

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Biography